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AUTHOR Houston, Samuel R.; And Others
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ABSTRACT

Salary data were gathered for 1985-86 from 463 faculty at the University of Northern Colorado. Discrimination variables studied included gender, race, and age, and university characteristic variables were rank, degree and tenure status, time in rank, and academic discipline. Multivariate procedures employed included multiple linear regression (MLR), partial canonical analysis (PCA), and judgment analysis (JAN) for double-cross validation purposes. PCA was found to be a promising tool for the researcher in the area of salary discrimination, as it was more revealing and sensitive than MLR in terms of suggesting areas for further investigation of possible gender, race, and age discrimination. It was found additionally that JAN procedures provide the ability to cross-validate the MLR procedures, and that MLR procedures, using partialled discrimination variables as the dependent variables, can be used as an alternative to the PCA approach. Results suggested that discrimination is less pervasive than in a prior 3-year study at the University. Includes 20 references. (JDD)

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SALARY DISCRIMINATION IN HIGHER EDUCATION:

SELECTED MULTIVARIATE ANALYSES[1]

by

Samuel R. Houston, Pensri Intarapanich, Robert L. Heiny, and Ann Thomas[2]

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[1]Paper presented at the American Educational Research Association Meeting in Boston, MA (April 16-20, 1990).

[2]All authors are affiliated with the University of Northern Colorado

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ABSTRACT

The primary purpose of the study was to determine if salary discrimination patterns in a higher education setting had changed in type and magnitude. Data were gathered from faculty at the University of Northern Colorado (N=463) for 1985-86. Discrimination variables included gender, race, and age while university characteristic variables studied were rank, degree and tenure status, time in rank and academic discipline. Selected multivariate procedures employed included multiple linear regression, partial canonical analysis and judgment analysis for double-cross validation purposes. Results suggest that discrimination is less pervasive than in a prior three-year study at the University.

Salary discrimination in higher education is an area of great social concern and the focus of much research during the past two decades in the United States. The federal civil right statutes do not forbid discrimination on the basis of academic discipline, as they do on the basis of race, age, gender, religion or national origin. Many studies have been undertaken to explore potential gender, age, and race differences in salaries paid to faculty members.

The real challenge is to define the pattern and magnitude of discrimination in faculty salaries. In addition, it is important to clarify appropriate statistical procedures that are "objective" and "sensitive" to "real" discrimination. Indeed, the situation in which we now find statistical "experts" testifying against each other over the same data set and drawing contradictory conclusions, is less than satisfactory.

Variables identified in major salary discrimination studies in higher education include the discrimination variables of gender, race, age and the university characteristic variables of academic rank, tenure status, academic college and/or discipline, publication record, and length of professional experience.

Gender continues to be the focus of much research within higher education settings. Schau and Heyward (1987) and Koch (1982) concluded that females were paid significantly less than male faculty members. Etaugh (1985) examined the changes in the status of females during 1972-84. He found that females were paid significantly less than males at every rank across disciplines and in all types of institutions.

Using race as a research variable, Ford (1984) studies the full-time faculty pay, controlling for length of service and academic rank at the

School of Management, Southwest University. It was found that white faculty received on average $462 more than non-white faculty in annual salary raises, and they earned on the average $4,200 more than non-whites.

Studying academic rank as the research variable, Etaugh (1985) stated that female faculty advanced through the academic ranks more slowly than male faculty, and tended to be concentrated in lower ranks. Previous research on faculty salaries generally agreed that rank is the strongest predictor of salary (Bodner, 1984; Katzs, 1973; Astin and Bayer, 1972). Prather and Posey (1981) recommended the use of rank, discipline, and academic experience in faculty salary models, while Simpson (1984) recommended the use of rank, department, academic year equated salary, and time in rank.

Using tenure as research variable, Etaugh (1985) found that in 1972 female faculty were less likely to be tenured and this situation still prevails. In the area of academic specialization, Gray (1985) recommended that the academic discipline should be controlled as a variable in studies of faculty salaries.

Multiple Linear Regression (MLR) has become the most widely utilized statistical tool in the analysis of faculty salaries and gender bias in higher education (Schau and Heyward, 1987; Bodner, 1984; Carter et al., 1984; Finkelstein and Levenback, 1983; Koch, 1983; Hengstler et al., 1983; Tanur and Cosar, 1978). Furthermore, according to many of the authors, stepwise techniques were frequently used in conjunction with MLR. It should be recognized that stepwise MLR approaches have serious limitations and potential flaws. With stepwise procedures, it is possible to specify rival subsets of independent variables which produce squared multiple

correlation (RSQ) values consistent with the original RSQ value. The problem which can emerge is that with stepwise regression methods, competing subsets of rival independent variables may lead researchers to draw different conclusions about the role of age, gender, and race in potential salary discrimination cases (Pedhazur, 1982). For this reason, the investigators prefer to utilize MLR backward elimination procedures for an objective analysis of data in salary discrimination studies.

Other research studies indicate that additional statistical techniques such as canonical and discrimination analysis of data in salary discrimination analysis have been used. Heiny et al. (1984) applied both methods in analyzing salary equity at the University of Northern Colorado (UNC) for three consecutive academic years--1982-83, 1983-84, and 1984-85.

Procedures

Data were gathered from University of Northern Colorado (UNC) faculty representing the 1985-86 academic years. The variables studied include rank, degree status, tenure status, gender, race, time in rank, college or school assignment at UNC, age and salary. Support for the variables selected grew out of the review of literature. Results for the academic year studied were compared with an earlier study of Heiny et al. (1984) to determine if the pattern and magnitude of salary discrimination have been altered at UNC.

Statistical procedures employed included multiple linear regression (MLR), partial canonical analysis (PCA) and judgment analysis (JAN) techniques for double-cross validation purposes. The statistical procedures employed and utilized were suggested by the findings in the

review of literature and/or were identified as potentially useful for research purposes.

A list of variables included in the 1985-86 analysis of salary discrimination is presented in Table 1. Information about the coding of each of the variables is also included in the table. The investigators essentially considered the variables as providing two types of information--discrimination (gender, race, and age) (Jain and Sloane, 1981) and university characteristics (tenure status, rank degree status, time in rank, and college or university assignment). These variables are considered important and typical (Schau and Heyward, 1987; Prather and Posey, 1981; Scott, 1977) of those explored by other researchers in the area.

Table 1

Variables Included in the Analysis of Salary Discrimination

Variable	Variable Name	Description
Rank		
V1	INSTR 85	Instr = 1, Other = 0
V2	ASSIS 85	Assis Prof = 1, Other = 0
V3	ASSOC 85	Assoc Prof = 1, Other = 0
Degree		
V4	MA	Highest Deg. is Master's = 1, Other = 0
V5	PHD	Highest Deg. is Doctorate = 1, Other = 0
Tenure Status		
V6	TENUR 85	Yes = 1, No = 0
Gender		
V7	GENDER	Male = 1, Female =0
Race		
V8	CAUC	Caucasian = 1, Other = 0

Table 1 continued

Variables Included in the Analysis of Salary Discrimination

Variable	Variable Name	Description
Time in Rank		
V9	YRINST 85	Number of Years as Instructor at UNC
V10	YRASSI 85	Number of Years as Assistant Professor at UNC
V11	YRASSO 85	Number of Years as Associate Professor at UNC
V12	YRPROF 85	Number of Years as Professor at UNC
Time Since Receiving Doctorate		
V13	YRWDOC	Number of Years with the Doctorate
Time Before Receiving Tenure		
V14	YRB4TEN	Number of Years before Receiving Tenure
Discipline		
V15	BUSI	Business = 1, Other = 0
V16	PHYSCI	Physical Sciences = 1, Other = 0
V17	SOCSCI	Social Sciences = 1, Other = 0
V18	HUMAN	Humanities = 1, Other = 0
V19	PVA	Performing and Visual Arts = 1, Other = 0
V20	HHS	Health and Human Services = 1, Other = 0; Else, Education
Age		
V21	AGE	Age in years
Salary		
V22	SAL 85	Academic Year Instructional Base Salary on a Nine-Month, Full-Time Basis

Regression Analyses

In Table 2 are presented the number of observations for qualitative variables of the study. These variables include information about rank, degree status, tenure status, race, and academic discipline of faculty members for the academic year studied. It is interesting to observe that the number of female non-Caucasian faculty members is less than ten. Also, the number of female faculty members is less then ten in the academic areas

of physical science, social science, and PVA. These numbers must be taken into consideration as one reviews results of the study.

Means and standard deviations for the quantitative variables are presented in Table 3. These variables include time in rank as instructor, assistant professor, associate professor and full professor, time since receiving the doctorate, time before receiving tenure, age and salary. The males appear to be about four years older on average than females and to have had their doctorate about six years longer than their female counterparts. This result only suggests that females completed the doctorate at an age about two years older than male faculty members.

Table 2

Number of Observations for Qualitative Variables

Variable	Combined (N=463)	Male (N=323)	Female (N=140)
Rank			
Instructor	60	23	37
Assistant Professor	101	52	49
Associate Professor	140	106	34
Professor	162	142	20
Degree			
Less than MA	16	6	10
Master's	164	91	73
Doctorate	283	226	57
Tenure Status			
Tenure	315	247	68
Non-Tenure	148	76	72
Race			
Caucasian	442	307	135
Non-Caucasian	21	16	5
Discipline			
Business	46	36	10

Table 2 continued

Number of Observations for Qualitative Variables

Variable	Combined (N=463)	Male (N=323)	Female (N=140)
Physical Science	56	53	3
Social Science	39	34	5
Humanities	63	45	18
PVA	50	43	7
HHS	38	14	24
Education	171	98	73

Table 3

Means and Standard Deviations for Quantitative Variables

Variable	Combined (N=463)	Male (N=323)	Female (N=140)
Years Instructor	1.38 (2.36)	1.06 (2.12)	2.12 (2.70)
Years Assistant Professor	3.44 (3.01)	3.56 (2.73)	3.17 (3.55)
Years Associate Professor	3.15 (3.15)	3.69 (3.11)	1.92 (2.90)
Years Professor	3.09 (4.99)	3.98 (5.42)	1.03 (2.95)
Time since Receiving Doctorate	7.95 (8.29)	9.80 (8.54)	3.41 (5.73)
Time before Receiving Tenure	3.27 (1.98)	3.20 (1.82)	3.41 (2.31)
Age	44.67 (8.68)	45.87 (8.23)	41.89 (9.08)
Salary	30,186 (6,411)	31,778 (6,038)	26,512 (5,716)

The investigators used multiple linear regression (MLR) to examine the relationship between salaries of full-time faculty members and a set of discrimination variables. The set of discrimination variables included gender (V7), race (V8), and age (V21). The Schmid-Reed (1966) flowchart approach, a backward elimination chunk-wise procedure, was used in an attempt to determine if the unique contribution of set of discrimination variables (and/or proper subsets of discrimination variables) was significantly related to the dependent variable of salary.

Salaries were regressed on the set of independent variables listed in Table 1, including all qualitative and quantitative variables. This model in MLR, identified as the full model or FMO, produced an RSQ value which was tested for statistical significance by means of an F-test (Pedhazur, 1982). The raw score coefficients and standard errors for the 1985-86 FMO are presented in Table 4.

Results of the MLR analyses clearly indicate that the FMO accounted for 89% of the variance in faculty salaries at UNC. When tested for significance, this finding was significant beyond the 0.01 level (F-test, Pedhazur, 1982). Collinearity diagnostics performed on the data failed to uncover any violations of the collinearity assumptions for MLR models.

In Table 5 are presented RSQ values for full and restricted (reduced) models which seek to ferret out any significant discrimination in the salary models as a result of gender, race or age. The unique contribution of the set of discrimination variables (gender, race and age) failed to reach statistical significance ($p > 0.01$) as evidenced by results in Table 5. Furthermore, the unique contribution of each discrimination variable considered separately (gender, race and age) in explaining faculty salaries

was not significant ($p > 0.01$). It is interesting to observe that the unique contribution of the set of discrimination variables was less than 0.5% collectively for all regression models (Table 5) in explaining faculty salary variation. This result is in sharp contract with results of the Heiny (1984) study in which the set of discrimination variables (gender, race and age) were found to make a significant ($p > 0.01$) unique contribution in explaining faculty salary models for the academic years 1982-83 and 1983-84. Furthermore, gender and age each made significant unique contributions ($p > 0.01$) as individual variables in explaining faculty salary variance for 1982-83 and 1983-84. Whatever institutional policies are in place at UNC, it appears that both the set and proper subsets of discrimination variables are now less a factor in explaining faculty salary variance.

Table 4

Regression Model for 1985-86 (N=463)

Salary Model	Coefficients for Full Model	Standard Error
INTERCEPT	29722.28	1269.69
INSTRUCTOR	-12514.97	725.70
ASSISTANT PROFESSOR	-8293.01	575.59
ASSOCIATE PROFESSOR	-4778.49	424.42
MA	1463.41	615.82
PHD	830.59	728.44
TENURE	-98.69	437.55
GENDER	543.98	252.76
CAUCASIAN	-102.65	504.93
AGE	57.78	18.37
YEARS INSTRUCTOR	55.64	57.58
YEARS ASSISTANT PROFESSOR	-44.90	49.13
YEARS ASSOCIATE PROFESSOR	130.35	53.23
YEARS PROFESSOR	356.87	49.64
TIME SINCE RECEIVING DOCTORATE	1.88	34.36
TIME BEFORE RECEIVING TENURE	64.43	62.12
BUSINESS	2183.61	375.70

Table 4 continued

Regression Model for 1985-86 (N=463)

Salary Model	Coefficients for Full Model	Standard Error
PHYSICAL SCIENCE	-384.35	361.56
SOCIAL SCIENCE	-187.36	409.62
HUMANITIES	-1179.54	340.53
PVA	-1420.50	379.48
HHS	281.72	400.65

RSQ	.89
F*	172.91
df	(21,441)

*Significant at 0.01 level

Judgment Analysis and Double Cross Validation of Salary Models

Borg and Gall (1983) and other contemporary researchers are concerned that cross-validation procedures are not undertaken in order to lend stronger support to the stability and validity of research findings. For this and other reasons, the investigators sought to inititate double-cross validation procedures. Schau and Heyward (1987) were critical of many research studies in the area of discrimination in higher education. They argue that combined gender salary models were possibly biased in favor of males. Instead they proposed developing and using a generic male salary model and validating the male model by using female faculty. The authors believe these researchers took a step which may provide additional information, but is incomplete. They sought to determine female bias by using a male salary model for validation purposes and reporting shrinkage. However, what they failed to consider was that it might be important to develop a female salary model and validate it by using males to identify potential female bias. This

Table 5

RSQ Values for Full and Restricted Models for 1985-86

Salary Model	1985-86 (N=463)
Full Model (FMO)	.8917 A
FMO - Discrimination Set (V7, V8, V21)	.8883 A
FMO - Gender (V7)	.8906 A
FMO - Race (V8)	.8917 A
FMO - Age (V21)	.8893 A

Note: RSQ values in a column with the same letter as the FMO are not significantly different from each other. All p's > 0.01.

approach would permit a comparison of the magnitude of gender bias in salary models for both males and females. This process, called double-cross validation, should be more "objective" than using cross-validation procedures only.

In Table 6 are presented results of double-cross validation procedures for 1985-86. In 1985-86, the female shrinkage was 4.43%, while the corresponding male shrinkage was 5.06%. It seems that if shrinkage is a measure of potential male or female bias, the bias is somewhat comparable. It appears that generic male salary models are about as sensitive to females as generic female salary models are to males.

Table 6

Double-Cross Validation of Male and Female Models for 1985-86

Model		1985-86
FMO for MM	RSQ	.8815
Females Applied to MM	RSQ	.8372
Female Shrinkage		.0443 NS
FMO for FM	RSQ	.8831
Males Applied to FMRSQ		.8325
Male Shrinkage		.0506 NS

Note: Not Significant ($p > 0.01$) Using Fisher's Test

However, the researchers believe that Judgment Analysis (JAN) is currently the most effective established procedure for capturing both male and female salary model policies in higher education as well as determining to what extent the captured salary models are compatible. JAN was originally suggested by Christal (1968) and a textbook of JAN application and procedures was prepared by Houston (1974).

JAN, as a starting point, determines a separate multiple linear regression equation to represent the policy for each participating judge. In this investigation, we have a two-judge system -- Judge 1 represents the generic male salary policy model while Judge 2 corresponds to the generic female policy model. After a separate multiple regression equation has been obtained for each judge, a clustering procedure is initiated which allows the investigators to determine if both male and female salary models are essentially equivalent or comparable. The interested reader is

referred to Christal (1968) and Houston (1974) for appropriate details involving both policy capturing, subsequent clustering of policies to determine the number of different policies, and hypothesis testing procedures.

In Table 7 are presented the RSQ and R values for the two judges (male and female salary model).

Table 7

RSQ and R Values for Two Salary Models

Judge	RSQ Value	Multiple R Value
1 (Male Policy)	0.8815	0.9389
2 (Female Policy)	0.8831	0.9397

Table 8, which follows, gives the RSQ values for the two clustering stages involved in the JAN procedure. At the first stage, the identity of each judge (male policy and female policy model) is retained and two potential policies are possible. In the second stage, the identity of

Table 8

Stages of the JAN Procedure for Two Policy Judges

Stage	Judges	RSQ	Successive Drop in RSQ Value
1	(1), (2)	0.8961	----------
2	(1, 2)	0.8867	0.0094*

*P > 0.01

each judge is not available for analysis purposes. What is expressed here is a single joint policy. The change in RSQ values (two-judge system vs. single judge) can be tested by means of an F test. In the example, F* = 2.024 with df = 19,425 which is not significant at the 0.01 level. The implication, of course, is that when we change from viewing salary policy models as a two-judge system (male and female) to a one-judge system, the loss in RSQ value is such that we have, in essence, just one salary policy in effect at UNC. In summary, there appears to be no reason to conceptualize a salary model from both a male and female point of view.

Partial Canonical Analyses

Partial canonical analyses (PCA's) were undertaken in an attempt to uncover possible additional sources of discrimination in salary patterns. The set of predictor variables (PV) or independent variables identified consisted of all the discrimination variables which included gender, race, and age. On the other hand, the set of dependent or criterion variables (CV) utilized were the university characteristic variables. These variables included academic rank, degree(s) earned, tenure status, years spent at each academic rank or level, and school or college in which the faculty member was assigned.

Tables 9-11, inclusive, present standardized partial canonical weights for the three models studied. Each table has one discrimination variable (gender, race, or age) partialled out from both sets of variables (predictor variables and criterion variables) and reflects results for the academic year of 1985-86. In Table 9, for instance, gender is partialled out from both sets of variables. Two significant canonical R's emerged (p

< 0.01) when Wilks' Lambda was converted to an approximate F and tested for significance.

Table 9

Partial Canonical Solution Using Standardized Weights for Significant Relationships for N=463 Observations (1985-86) with Gender Partialled Out

Predictor Variables	Standardized Predictor Weights PV1	PV2	Criterion Variables	Standardized Criterion Weights CV1	CV2
Caucasian	.09	1.00	Inst	-.31	.44
Age	.99	-.12	Asst	-.22	.34
			Asso	.06	-.39
			MA	.13	.45
			PhD	.04	.50
			Tenure	-.23	-.23
			Yrs. Inst.	.19	.39
			Yrs. Asst.	.30	.12
			Yrs. Asso.	.36	.53
			Yrs. Prof.	.77	.07
			Busi	.05	-.01
			PhySci	-.07	.19
			SocSci	-.05	-.52
			Human	-.03	-.33
			PVA	-.10	.18
			HHS	-.02	-.13
			Canonical R	.75*	.26*

*Wilks' Lambda Significant at .01 when converted to an approximate F.

The next three tables, Tables 12-14, present the corresponding structure coefficients (loadings) associated with the significant partial canonical R's found in the prior three tables, Tables 9-11. These loadings, as in the case of canonical analysis, are most useful in interpreting results of PCA's.

In Table 12, results are presented in which gender has been partialled out of both the PV and CV sets. For the academic year 1985-86, two significant partial canonical R's were detected ($p < 0.01$.). The first

relationship which emerged is that the predictive factor of age seems related to the professorial experience factor in the criterion set. The second partial canonical R, which was significant ($p. < 0.01$), suggested that the predictive factor of Caucasian status was related to the criterion factor with positive loadings on instructor, possession of master's degree, years instructor, and negative loadings on associate professor rank, possession of doctorate, member of social science faculty, and member of the humanities. The fact that nursing faculty tend to have completed their

Table 10

Partial Canonical Solution Using Standardized Weights for Significant Relationships for N=463 Observations (1985-86) with Race Partialled Out

Predictor Variables	Standardized Predictor Weights PV1	PV2	Criterion Variables	Standardized Criterion Weights CV1	CV2
Gender	.26	-.99	Inst	-.32	-.06
Age	.91	.46	Asst	-.23	.12
			Asso	.05	.12
			MA	.12	.03
			PhD	.05	-.17
			Tenure	-.17	-.43
			Yrs. Inst.	.12	.48
			Yrs. Asst.	.24	.36
			Yrs. Asso.	.32	.20
			Yrs. Prof.	.70	.53
			Busi	.08	-.32
			PhySci	-.02	-.47
			SocSci	-.00	-.31
			Human	-.01	-.12
			PVA	-.04	-.47
			HHS	-.05	.26
			Canonical R	.78*	.38*

*Wilks' Lambda Significant at .01 when converted to an approximate F.

master's degree (but not their doctorate) and not to be in the associate professor rank may be a partial explanation. The characteristics of faculties from both the humanities and social science disciplines should be examined on a case-by-case basis to see if other "logical" explanations emerge.

In Table 13 are presented PCA results in which race (Caucasian Status) has been partialled out from both PV and CV sets. The first two partial R's were found to be significant ($p < 0.01$). The first significant partial canonical R seems to suggest that an older male factor (PV set) is related to an experienced professional (with a doctorate) who is tenured. On the

Table 11

Partial Canonical Solution Using Standardized Weights for Significant Relationships for N=463 Observations (1985-86) with Age Partialled Out

Predictor Variables	Standardized Predictor Weights PV1	PV2	Criterion Variables	Standardized Criterion Weights CV1	CV2
Gender	.99	.12	Inst	-.31	.20
Caucasian	-.08	1.00	Asst	-.29	.16
			Asso	-.03	-.34
			MA	.05	.50
			PhD	.13	.52
			Tenure	.16	-.26
			Yrs. Inst.	-.29	.42
			Yrs. Asst.	-.07	.24
			Yrs. Asso.	.07	.63
			Yrs. Prof.	.31	.07
			Busi	.31	.07
			PhySci	.32	.20
			SocSci	.27	-.48
			Human	.10	-.31
			PVA	.30	.17
			HHS	-.22	-.18
			Canonical R	.45*	.27*

*Wilks' Lambda Significant at .01 when converted to an approximate F.

other hand, the second significant partial canonical R ($p < 0.01$) seems to suggest that the female factor (PV set) seems positively related to selected criterion variables--possession of master's degree, years instructor, faculty in HHS, and negatively related with possession of doctorate, physical science faculty, and PVA faculty. Again, results for

Table 12

Useful Structure Coefficients (Loadings) in Explaining Relationships between significantly Correlated Canonical Variate with Gender Partialled Out/

Discrimination Variable	1985-86 PV1	PV2
Caucasian		*+
Age	*+	
University Status Variables	**1985-86 CV1**	**CV2**
Inst	*-	*+
Asst	*-	
Asso		*-
MA		*+
PhD	*+	*-
Tenure	*+	
Yrs. Inst.		*+
Yrs. Asst.	*+	
Yrs. Asso.	*+	
Yrs. Prof.	*+	
Busi		
PhySci		
Soc Sci		*-
Human		*-
PVA		
HHS		
Canonical R	.75	.26

/ Structure coefficients > = .30 were considered as meaningful (Pedhazur's criterion).
A "*+" represents a positive coefficients > = .30 and a "*-" refers to a negative structure loading > = ABS (.30).

the partial canonical correlation analysis suggest that a case-by-case analysis would be in order to see if possible contemporary factors, historical facts, and/or current market constraints explain these findings.

Table 13

Useful Structure Coefficients (Loadings) in Explaining Relationships between Significantly Correlated Canonical Variate with Race Partialled Out/

Discrimination Variables	1985-86 PV1	PV2
Gender	*+	*-
Age	*+	
University Status Variables	**1985-86 CV1**	**CV2**
Inst	*-	
Asst	*-	
Asso		*+
MA	*-	*-
PhD	*+	
Tenure	*+	
Yrs. Inst.		*+
Yrs. Asst.	*+	
Yrs. Asso.	*+	
Yrs. Prof.	*+	
Busi		
PhySci		*-
Soc Sci		
Human		
PVA		*-
HHS		*+
Canonical R	.78	.38

/ Structure coefficients > = .30 were considered as meaningful (Pedhazur's criterion).
A "*+" represents a positive coefficients > = .30 and a "*-" refers to a negative structure loading > = ABS (.30).

The partial canonical analyses presented in Table 14 have age partialled out from both the PV and CV sets. Two partial cnaonical R's were found to be significant ($p < 0.01$) for 1985-86. The first significant partial canonical R indicated that a male factor (PV set) was positively related to

Table 14

Useful Structure Coefficients (Loadings) in Explaining Relationships between Significantly Correlated Canonical Variate with Age Partialled Out/

Discrimination Variables	1985-86 PV1	PV2
Caucasian	*+	
Gender		*+
University Status Variables	**1985-86 CV1**	**CV2**
Inst	*-	
Asst	*-	
Asso		*-
MA	*-	
PhD	*+	
Tenure	*+	
Yrs. Inst.	*-	
Yrs. Asst.		
Yrs. Asso.	*+	
Yrs. Prof.	*+	*+
Busi		
PhySci	*+	*+
Soc Sci		*-
Human		
PVA		
HHS	*-	
Canonical R	.45	.27

/ Structure coefficients > = .30 were considered as meaningful (Pedhazur's criterion).
A "*+" represents a positive coefficients > = .30 and a "*-" refers to a negative structure loading > = ABS (.30).

possession of doctorate, tenure status, years associate professor, years professor, physical science faculty, and negatively related to instructor rank, assistant professor rank, possession of master's degree, years instructor, and faculty member in HHS in the criterion factor (CV set). Finally, the second significant partial canonical analysis suggests that race (PV set) is linked in a positive manner with years as a professor, physical science faculty, and negatively with associate professor rank, and social science faculty. Since the factor of age was partialled out of both sets of variables, these results suggest further exploration for possible gender and race discrimination on a case-by-case basis.

To further validate the results obtained by PCA, a multiple linear regression analysis was conducted in the following manner. One of the three variables referred to as discriminatory variables (GENDER, AGE, CAUCASIAN) was selected. That variable and all criterion variables were partialled on the remaining two discriminatory variables. A multiple regression model using the discriminatory variable with the other two discrimination variables partialled out was used as the dependent variable. Criterion variables with the same two discrimination variables partialled out were used as the independent variables.

The resulting regression model exhibits relationships among the criterion variables which may or may not be appropriate when being compared to the discrimination variables of GENDER, AGE or CAUCASIAN. The results of these three regression analyses are shown below in Tables 15-17.

Table 15

Regression Model: Dependent Variable: GENDER with AGE, CAUCASIAN Partialled Out. All Independent Variables are partialled on AGE and CAUCASIAN Variables.

Variables	Coefficients for Full Model	Standard Error
Intercept	0.	.0197
Instructor	-.2848	.1450
Assistant	-.1768	.1098
Associate	-.0270	.0796
MA	.0910	.0812
BA	-.0875	.2452
Tenure	.0529	.0876
Years Instructor	-.0202	.0110
Years Assistant	-.0029	.0090
Years Associate	.0011	.0105
Years Professor	-.0006	.0093
Time Since Receiving Doctorate	.0138	.0065
Time Before Receiving Tenure	-.0003	.0042
Business	.2532	.0723
Physical Science	.2188	.0672
Social Science	.2066	.0766
Humanities	.0804	.0662
PVA	.2359	.0732
HHS	-.1506	.0774

RSQ = .219

The dependent variable of GENDER is not closely related to the criterion variables with the possible exception of the discipline variables and the variable involving years with the doctorate. This result is consistent with the PCA results and the original multiple regression results using salary as the dependent variable.

Table 16

Regression Model: Dependent Variable: CAUCASIAN with AGE AND GENDER Partialled Out. All Independent Variables are partialled on AGE and GENDER Variables.

Variables	Coefficients for Full Model	Standard Error
Intercept	0.	.0104
Instructor	.0325	.0766
Assistant	.0205	.0579
Associate	-.0409	.0418
MA	-.0637	.0427
BA	.0692	.1290
Tenure	-.0358	.0461
Years Instructor	.0130	.0058
Years Assistant	.0048	.0047
Years Associate	.0093	.0055
Years Professor	-.0004	.0049
Time Since Receiving Doctorate	.0064	.0034
Time Before Receiving Tenure	-.0003	.0022
Business	-.0040	.0387
Physical Science	.0146	.0359
Social Science	-.1122	.0403
Humanities	-.0625	.0347
PVA	.0137	.0390
HHS	-.0329	.0409

RSQ = .0803

This multiple regression model indicates that the CAUCASIAN variable is not associated with any of the criterion variables with the exception of the variable SOCIAL SCIENCES. This analysis also confirms the previous results that the race factor is not significant when considering salary, tenure or promotion decisions at UNC.

Table 17

Regression Model: Dependent Variable: AGE with GENDER, CAUCASIAN Partialled Out. All Independent Variables are partialled on GENDER and CAUCASIAN Variables.

Variables	Coefficients for Full Model	Standard Error
Intercept	0.	.2713
Instructor	-8.0292	1.9633
Assistant	-3.3458	1.5066
Associate	.2162	1.0960
MA	4.7087	1.0935
BA	1.3627	3.3758
Tenure	-2.1294	1.2022
Years Instructor	.6177	.1489
Years Assistant	.6028	.1205
Years Associate	.4713	.1425
Years Professor	.5636	.1255
Time Since Receiving Doctorate	.4594	.0867
Time Before Receiving Tenure	-.1107	.0576
Business	2.2076	1.0054
Physical Science	-1.1827	.9371
Social Science	-.1537	1.0645
Humanities	-.0647	.9129
PVA	-.9328	1.0198
HHS	.2085	1.0702

RSQ = .5940

The variable of AGE is related to the predictor variables. The relationships are expected and appropriate. This variable is inversely related to the status of instructor and assistant professor. It is directly related to years of each rank, the discipline of business, and possession of the masters degree as the highest degree. This latter result is a reflection of the policy to hire only doctorally qualified faculty members since the mid 1970's. This analysis once again confirms previous results in this paper.

In summary, PCA results seem more revealing and sensitive in terms of suggesting areas for further investigation of possible gender, race, and age discrimination than do the results of MLR. PCA seems promising as another tool for the researcher in the area of salary discrimination in higher education. In addition, JAN procedures provide the ability to cross-validate the MLR procedures commonly used in discrimination analyses.

MLR procedures, using partialled discrimination variables as the dependent variables, are an alternative to the PCA approach used in this paper. Both the JAN and MLR procedures validate the common approaches for this data set. Further studies using institutional data sets where discrimination is present need to be made to validate these alternative multivariate procedures.

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